

## **Demonstration to Provide for the Removal of the 7.8 PSI Reid Vapor Pressure (RVP) Gasoline Requirement in Jefferson and Shelby Counties**

On March 2, 2012, the Alabama Department of Environmental Management (ADEM) submitted to the U.S. Environmental Protection Agency (EPA) a proposed revision to Alabama's SIP removing Chapter 335-3-20 "Control of Fuels", which included the rule that required the use of 7.0 psi Reid Vapor Pressure (RVP) gasoline in Jefferson and Shelby counties (the Birmingham area) during the RVP control period, which runs from June 1<sup>st</sup> through September 15<sup>th</sup> of each year. EPA approved this revision on April 20, 2012 (77 FR 23619). The revision to the SIP resulted in the default federal RVP requirement of 7.8 psi applying to the area. Through this technical demonstration, ADEM is now requesting that EPA take the necessary steps to change the federal RVP requirement to 9.0 psi during the summer months in the Birmingham area.

Section 211(h) of the Clean Air Act (CAA) requires EPA to set a maximum gasoline RVP standard of 9.0 psi during the summer ozone season. Additionally, this section also provides EPA with the authority to establish more stringent RVP standards in nonattainment areas "as the Administrator finds necessary to generally achieve comparable evaporative emissions (on a per vehicle basis) in nonattainment areas, taking into consideration the enforceability of such standards, the need of an area for emission control, and economic factors."

The lower RVP requirement was clearly intended to reduce emissions of evaporative volatile organic compounds (VOC). At the time the regulations were adopted, the control

of VOC emissions was thought to be an effective strategy for reducing ground-level ozone. As scientific understanding of ozone formation in the Southeast U.S. evolved, it was discovered that nitrogen oxide (NO<sub>x</sub>) emissions played a much larger role in the creation of ground-level ozone than that of VOC emissions (See Attachment A). This is primarily due to the abundance of biogenic VOC emissions in the region.

While the relaxation of the RVP level would result in a very slight increase in both VOC and NO<sub>x</sub>, this increase is more than offset by the decrease in emissions resulting from fleet turnover (Point 6 below). The demonstration clearly shows a downward trend in overall NO<sub>x</sub> and VOC emissions continuing through 2024. Therefore, the RVP relaxation will not affect the Birmingham area's ability to comply with the 1997 and 2008 ozone standard, the 2010 1-hour NO<sub>2</sub> standard, or the PM<sub>2.5</sub> standards. Additionally, the relaxation of the RVP level will not significantly affect emissions of lead, carbon monoxide or sulfur dioxide and will not affect the ability of the area to comply with the current NAAQS for these pollutants.

ADEM is requesting the change to 9.0 psi for the summertime gasoline RVP requirement for the Birmingham area for the following additional reasons:

1. As shown below, the lower federal RVP requirement does very little to reduce ozone precursor emissions and therefore is an ineffective strategy for reducing ozone concentrations.
2. Low RVP fuel likely increases refining costs. The distribution system in the Birmingham area must segregate low RVP and normal RVP supplies in pipelines, storage, and transport. ADEM estimates that these costs lead to an increased

- expenditure by Birmingham area consumers of at least \$9 million per ozone season.
3. Significant resources are expended by regulatory agencies and the marketing system to insure compliance with low RVP rules, for negligible air quality benefit.
  4. A new NAAQS for ozone is expected to be announced in 2015. If the Birmingham area violates the new standard, ADEM will be reviewing all feasible ozone reduction measures in the future. In light of the ineffectiveness of low RVP gasoline as a means to reduce ozone, and even if 9.0 RVP gasoline were in place in Birmingham and other Southeast areas now, no regulatory agency in the Southeast would consider lowering RVP as a viable ozone reduction measure.
  5. The ozone maintenance plan for the 1997 8-hour ozone standard presumed that a summertime gasoline RVP of 9.0 psi would be in place for future years.
  6. ADEM applied the MOVES model to evaluate the potential effects on emissions of VOC and NO<sub>x</sub> from vehicles only in the Birmingham area (Jefferson and Shelby Counties) resulting from increasing summertime gasoline RVP from 7.8 psi to 9.0 psi in the summer of 2015. Results of this modeling are shown in Table 1 below. The analysis indicates that summertime emissions of NO<sub>x</sub> and VOC would be expected to increase by about 24 tons and 80 tons, respectively, in 2015 solely due to the RVP relaxation. Additional model runs were carried out to isolate the effects of 2014-2015 fleet turnover on emissions. As shown in the table, the emissions reductions resulting from fleet turnover from 2014 to 2015 alone far outweigh the slight increase of emissions produced from the 7.8 psi to

9.0 psi gasoline RVP increase. Also included in the table is the net change in NO<sub>x</sub> and VOC emissions from 2014 (RVP 7.8) to 2015 (RVP 9.0). For comparison purposes, Table 1 also shows total emissions from all sources in the Birmingham area. It is clear that the small increase in emissions from the RVP relaxation is insignificant compared to the decrease in emissions from fleet turnover and total emissions from all sources in the area. It should also be noted that fleet turnover will result in a continued decrease in emissions from mobile sources in future years (See Figures 1-4). Supporting modeling files are available upon request. The version of the MOVES model used for the information in this document is MOVES2010b. Due to the timing of the release of the updates to the MOVES model, MOVES2010 was used for the 24-Hour PM<sub>2.5</sub> maintenance plan, and MOVES2010a was used for the Annual PM<sub>2.5</sub> maintenance plan. MOVES2010a was a minor update to MOVES2010. MOVES2010a allowed MOVES users to account for emissions under new car and light truck energy and greenhouse gas standards. There were also several improvements to MOVES general performance. MOVES2010a included reductions in greenhouse gases associated with those standards in future calendar years, and small reductions in refueling and sulfur-related emissions associated with the reductions in vehicle fuel consumption. The net impact of these changes on criteria pollutants was small. With MOVES2010a, regional inventory runs should see an increase in methane emissions and a small decrease in the VOC and air toxics emissions from these same emissions in MOVES2010.

MOVES2010b was a second update to MOVES2010. MOVES2010b builds on the functionality of the other MOVES versions. More detailed pollutant output has been added to MOVES2010b. Air toxics emissions calculations have been improved with this version of the model. Minor changes to standard air toxics coefficients may result in small changes to air toxics emissions. MOVES2010b does not significantly affect the criteria pollutant emissions results of MOVES2010.

**Table 1 – Effects on NO<sub>x</sub> and VOC Emissions from RVP Relaxation and Fleet Turnover**

|                       | <b>Emissions Increase in 2015 Due to RVP Change of 7.8 to 9.0 (tons)</b> | <b>Emissions Decrease Resulting from 2014 to 2015 Fleet Turnover (tons)</b> | <b>Net Mobile Source Emissions Change From 2014 (RVP=7.8) to 2015 (RVP=9.0) (tons)</b> | <b>2015 Emissions from All Sources (tons)</b> | <b>% Increase in Emissions due to RVP Change compared to Emissions from All Sources</b> |
|-----------------------|--|---|--|---|---|
| <b>NO<sub>x</sub></b> | 24   | -489  | -465   | 16,857  | 0.14  |
| <b>VOC</b>            | 80   | -156  | -76  | 11,791  | 0.68  |

Emissions are estimated for Jefferson and Shelby Counties for the period June 1 through September 15.

#### **Further Explanation of Table 1**

MOVES2010b was used to perform two runs for 2015. One run used an RVP of 7.8 psi, while the other used an RVP of 9.0. The difference in the NO<sub>x</sub> and VOC emissions for these two runs provided the “Emissions Increase in 2015 Due to RVP Change of 7.8 to 9.0”, which is the second column of Table 1. The overall increase in NO<sub>x</sub> emissions for 2015 due solely to the RVP change was 24 tons. It

should be noted that this emissions increase shown in the second column of Table 1 will never be realized in the real world. The real world emissions changes from 2014 to 2015 resulting from the RVP change and fleet turnover will be closer to the values shown in the fourth column of Table 1.

MOVES2010b was used to perform two runs to account for fleet turnover in 2015. The RVP was held constant at 7.8 with one run for 2014 and another run for 2015. The difference in the NOx emissions for these two runs provided the “Emissions Decrease Resulting from 2014 to 2015 Fleet Turnover”, which is the third column of Table 1. The overall decrease in NOx emissions for 2015 due to fleet turnover was 489 tons. The increase in NOx emissions of 24 tons due to the RVP change only was minimal compared to the decrease in NOx emissions of 489 tons due to fleet turnover.

Overall, there would still be a net decrease in NOx emissions from 2014 to 2015 of 465 tons. This is reflected in the “Net Mobile Source Emissions Change From 2014 (RVP=7.8) to 2015 (RVP=9.0)” which is the fourth column of Table 1.

The supporting modeling files for the mobile runs are provided on the enclosed disc.

7. The Birmingham area is presently in compliance of the 2008 8-hour ozone standard for the years 2012-2014. The improvements in the ambient air quality data over this period were attributable to a combination of national measures, local controls, unit shutdowns and weather patterns.

**Table 2 – Ambient Ozone Monitoring Data from 2012-2014**  
**(parts per million)**

| Monitor             | 2012  | 2013  | 2014  | 2012-2014<br>Design Value |
|---------------------|-------|-------|-------|---------------------------|
| Fairfield           | 0.077 | 0.063 | 0.065 | 0.068                     |
| McAdory             | 0.078 | 0.063 | 0.065 | 0.068                     |
| Hoover              | 0.074 | 0.065 | 0.062 | 0.067                     |
| Pinson*             | 0.075 |       |       |                           |
| Tarrant             | 0.084 | 0.065 | 0.063 | 0.070                     |
| Corner              | 0.071 | 0.064 | 0.061 | 0.065                     |
| Providence*         | 0.073 |       |       |                           |
| North<br>Birmingham | 0.079 | 0.058 | 0.065 | 0.067                     |
| Leeds               | 0.080 | 0.066 | 0.063 | 0.069                     |
| Helena              | 0.076 | 0.067 | 0.063 | 0.068                     |

\*Monitors closed after the 2012 monitoring season

8. Two PM<sub>2.5</sub> maintenance plans are presently in place for the Birmingham area: the 1997 annual PM<sub>2.5</sub> and the 2006 24-hour PM<sub>2.5</sub> maintenance plans. Using MOVES2010, a 7.8 psi RVP was assumed for the 2006 24-hour PM<sub>2.5</sub> maintenance plan. Using MOVES2010a, a 9.0 psi RVP was assumed for the 1997 annual PM<sub>2.5</sub> maintenance plan. Subsequent to the submission of these two plans,

the MOVES model was revised to version 2010b. An evaluation of the mobile source emissions in both plans was carried out using MOVES 2010b, while also assuming a 9.0 psi RVP for both. The results of this analysis are demonstrated in the following tables:

**Table 3 - Mobile Source Budgets for the 1997 Annual PM2.5 Birmingham Maintenance Plan**

|       | Current Annual<br>NOx and PM2.5<br>Budgets using<br>MOVES 2010a<br>(tons/year)<br>2024<br>RVP = 9.0 | Annual NOx<br>and PM2.5<br>emissions using<br>MOVES 2010b<br>(tons/year)<br>2024<br>RVP = 9.0 | Difference | % Change |
|-------|---|---|------------|----------|
| NOx   | 15,981.50   | 15,984.76   | 3.26       | 0.02     |
| PM2.5 | 442.07  | 442.07  | 0          | 0.00     |

**Table 4 - Mobile Source Budgets for the 2006 24-Hour PM2.5 Birmingham  
Maintenance Plan**

|       | Current 24-<br>Hour NOx and<br>PM2.5 Budgets<br>using MOVES<br>2010 (tons/day)<br>2024<br>RVP = 7.8 | 24-Hour NOx<br>and PM2.5<br>emissions using<br>MOVES 2010b<br>(tons/day)<br>2024<br>RVP = 9.0 | Difference | % Change |
|-------|---|---|------------|----------|
| NOx   | 48.41   | 48.73   | 0.32       | 0.66     |
| PM2.5 | 1.21  | 1.24  | 0.03       | 2.48     |

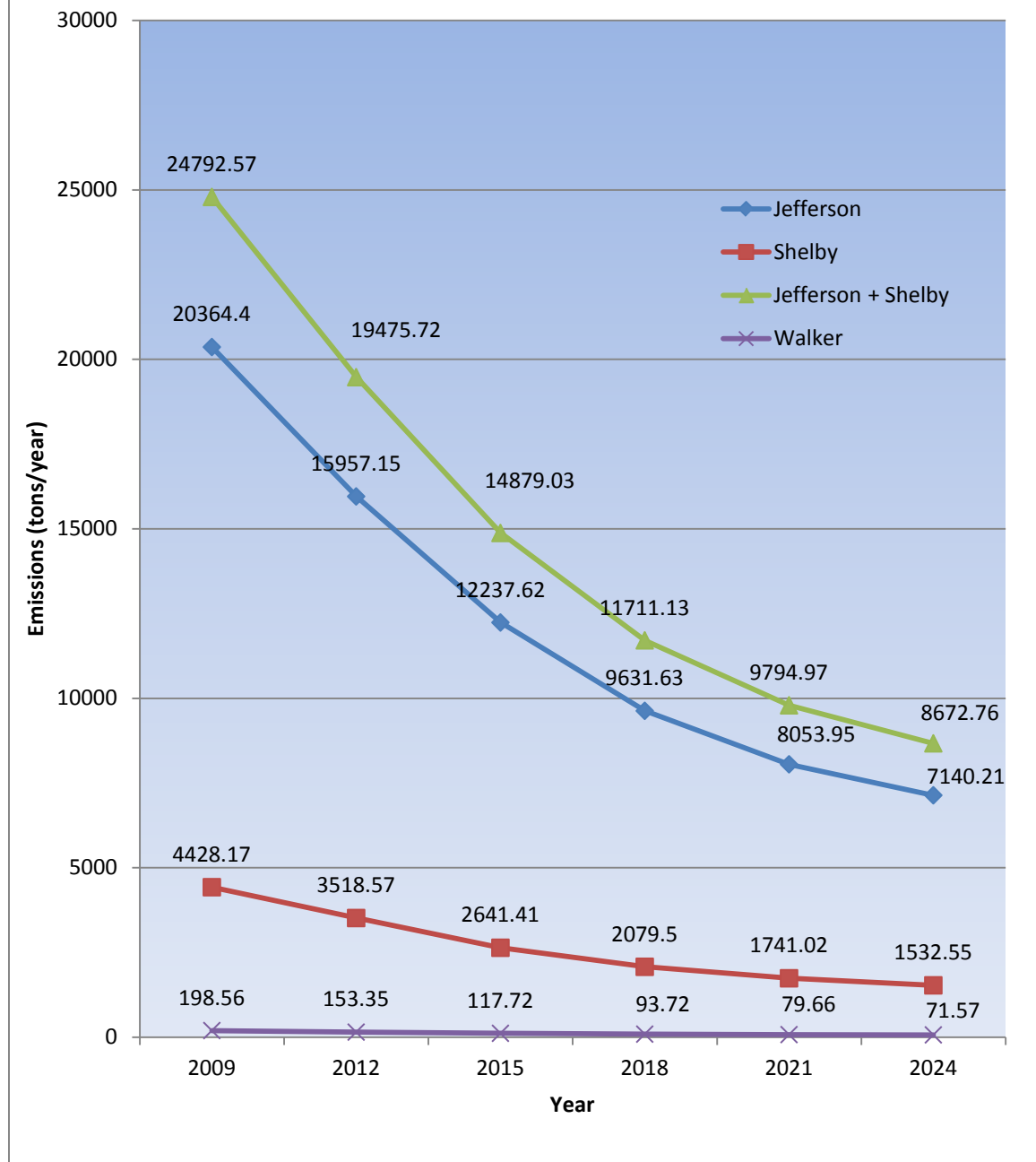
As shown in the tables, the resulting differences in emissions when utilizing MOVES 2010b and a 9.0 psi RVP were of such insignificance that the decision was made not to revise the maintenance plans for the purpose of this demonstration.

An evaluation of the NOx and VOC emissions during the years covered by the two maintenance plans as well as the calculation of emissions benefits was also carried out using MOVES 2010b while assuming a 9.0 psi RVP level. As the graphs below demonstrate, a clear downward trend is shown for both NOx and VOC in future years even with 9.0 psi gasoline.

Mobile6.2 was used for the current 8-Hour ozone maintenance plan. The most current model, MOVES2010b, was used for this RVP Technical Demonstration.

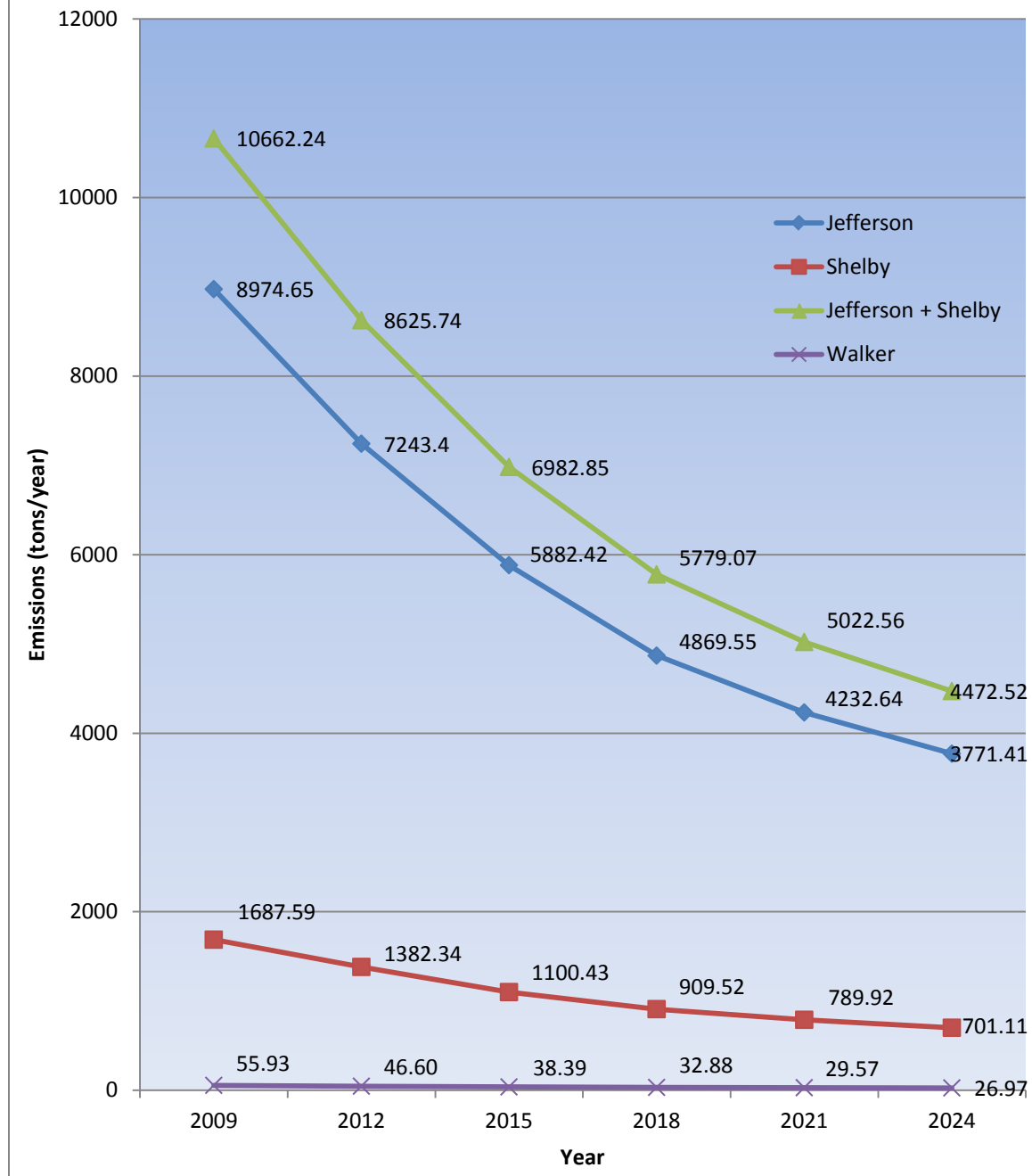
Generally, NOx emissions estimates tend to be significantly higher in MOVES than in MOBILE6. This can vary significantly depending on the area. However, both models predict a distinct downward trend in future year NOx and VOC emissions as a result of fleet turnover. The emissions represented in Table 1 of this demonstration, represent emissions and calculations based on the ozone period (June 1-September 15). In both the ozone maintenance plan and this RVP demonstration, both NOx and VOC emissions show a downward trend even with an assumed RVP of 9.0 in future years. This is substantiated by both models. The 1997 8-hour ozone maintenance plan established mobile source emissions budgets of 42 tons per day for NOx and 23 tons per day for VOC for years 2017 and beyond. The daily NOx and VOC projections for future years assuming an RVP of 9.0 shown in Figures 3 and 4 are consistent with this budget.

**Figure 1**  
**Annual NOx Trend 2009-2024\***



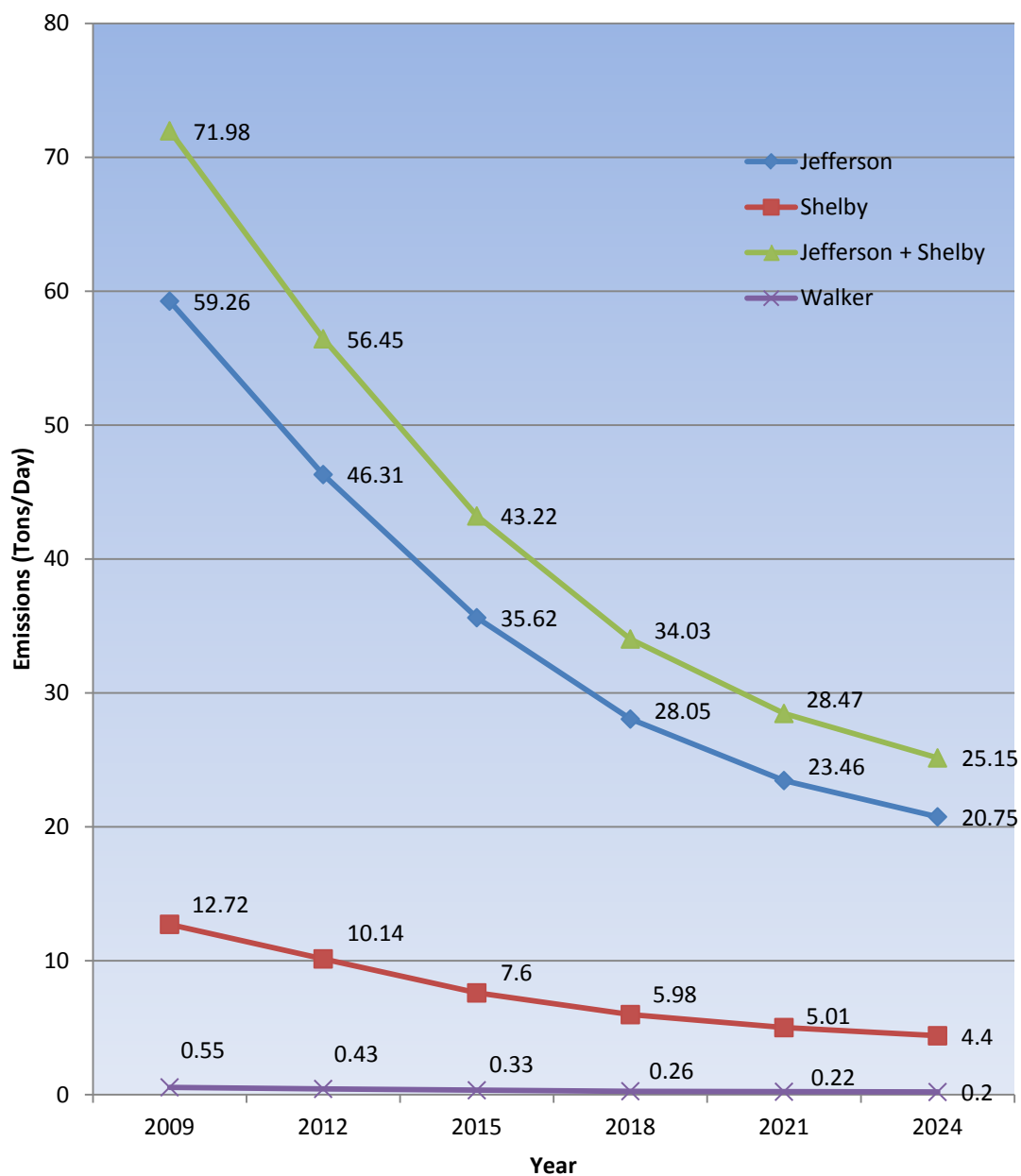
\*2009 = 7.0 psi RVP; 2012 = 7.8 psi RVP; 2015-2024 = 9.0 psi RVP

**Figure 2**  
**Annual VOC Trend 2009-2024\***



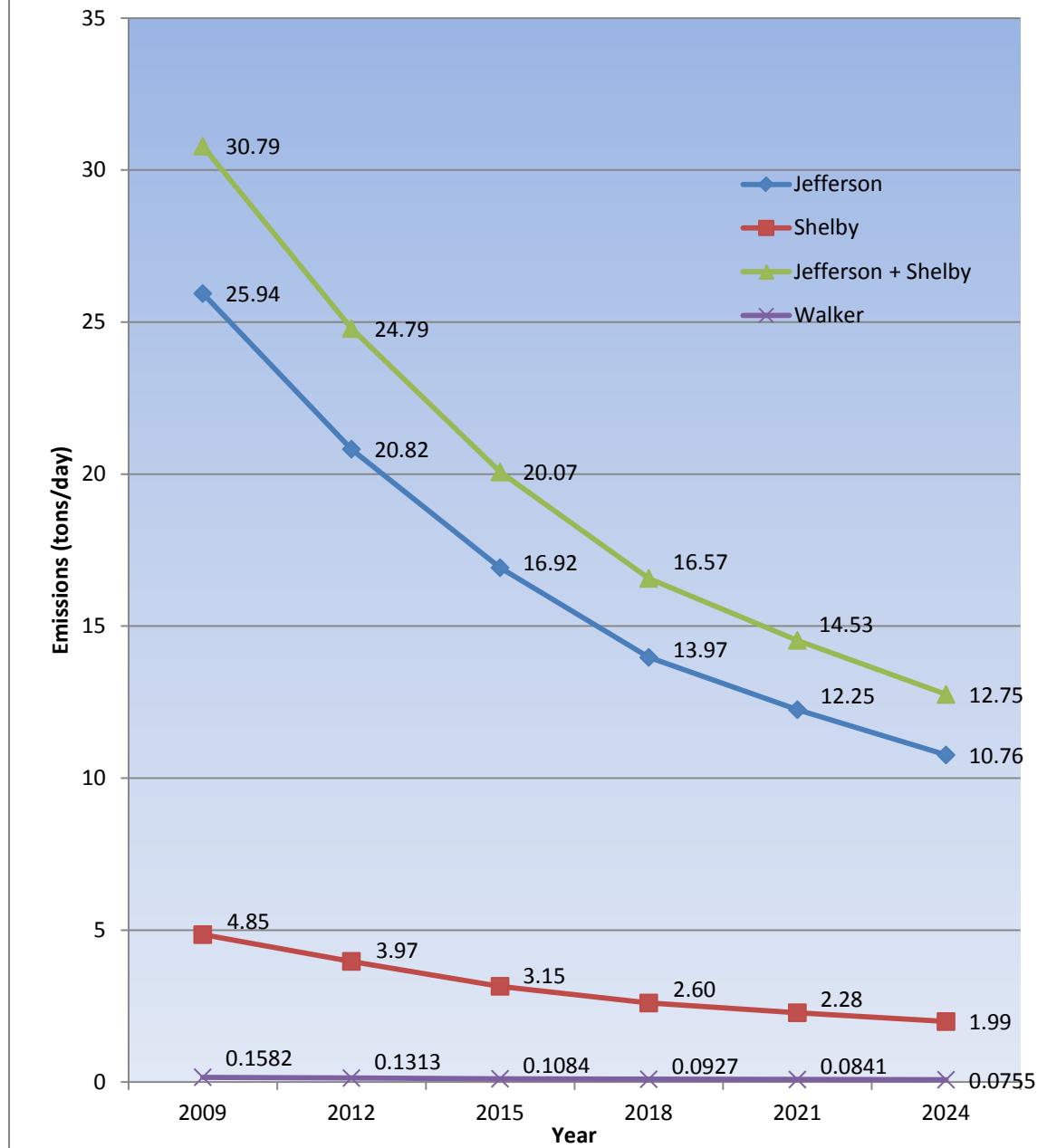
\*2009 = 7.0 psi RVP; 2012 = 7.8 psi RVP; 2015-2024 = 9.0 psi RVP

**Figure 3**  
**24-Hour NOx Trend 2009-2024\***



\*2009 = 7.0 psi RVP; 2012 = 7.8 psi RVP; 2015-2024 = 9.0 psi RVP

**Figure 4**  
**24-Hour VOC Trend 2009-2024\***



\*2009 = 7.0 psi RVP; 2012 = 7.8 psi RVP; 2015-2024 = 9.0 psi RVP

It is our conclusion that the 7.8 psi summertime gasoline RVP requirement has minimal impact on lowering ozone concentrations in the Birmingham area. Because of this, as previously mentioned, a summertime RVP of 9.0 psi was used in the current maintenance plan for the 1997 8-hour ozone standard.

The Birmingham area currently meets the 2008 8-hour 75 ppb ozone standard for the period 2012-2014. As shown in the graphs above, future emissions of NO<sub>x</sub> and VOC from mobile sources in the Birmingham area are predicted to continue a steady downward trend in future years with 9.0 psi gasoline.

ADEM has made previous submissions demonstrating that NO<sub>x</sub> emissions do not significantly contribute to PM<sub>2.5</sub> formation in the Birmingham area. Nevertheless, based on the figures shown above, relaxation of summertime RVP in Birmingham from 7.8 psi to 9.0 psi is not expected to increase NO<sub>x</sub> emissions significantly and should not interfere with maintenance of the PM<sub>2.5</sub> standards in the area. Future year emissions of NO<sub>x</sub> and VOC from mobile sources in the Birmingham area are predicted to continue a steady downward trend in future years with 9.0 psi gasoline.

ADEM believes that the information provided in this technical demonstration is sufficient to enable EPA to proceed with rulemaking to raise gasoline RVP for the Birmingham area to 9.0 psi beginning with the 2015 ozone season.

## Attachment A

### NO<sub>x</sub>/VOC Ozone Sensitivity Analysis

As previously shown in this demonstration, the gasoline RVP requirement in Jefferson and Shelby Counties does very little toward reducing ozone precursor emissions, and it primarily reduces VOC emissions, which are relatively unimportant in the formation of ozone in Birmingham. The analysis presented in this Attachment shows that VOC controls, even over a broad region, are ineffective in reducing ozone concentrations in Birmingham.

Over the last 20 years, scientific understanding of ozone formation in the Southeastern US has continued to evolve through analyses and modeling performed in support of State Implementation Plan development. One of the findings that has evolved from these efforts is the relative insensitivity of ground level ozone to reductions in anthropogenic VOC emissions in the southeastern US. This is due in large part to the abundance of VOC emissions from natural sources (forests, etc.). As part of the ASIP<sup>1</sup> and SEMAP<sup>2</sup> projects, Georgia Tech performed modeling sensitivity analyses to examine the impact of NO<sub>x</sub> and VOC emissions reductions on 8-hour ozone concentrations. The modeling was performed using a June 1-July 10, 2002, summer episode with a 12 km modeling domain and 2009 on the way<sup>3</sup> (OTW) Base D Emissions.

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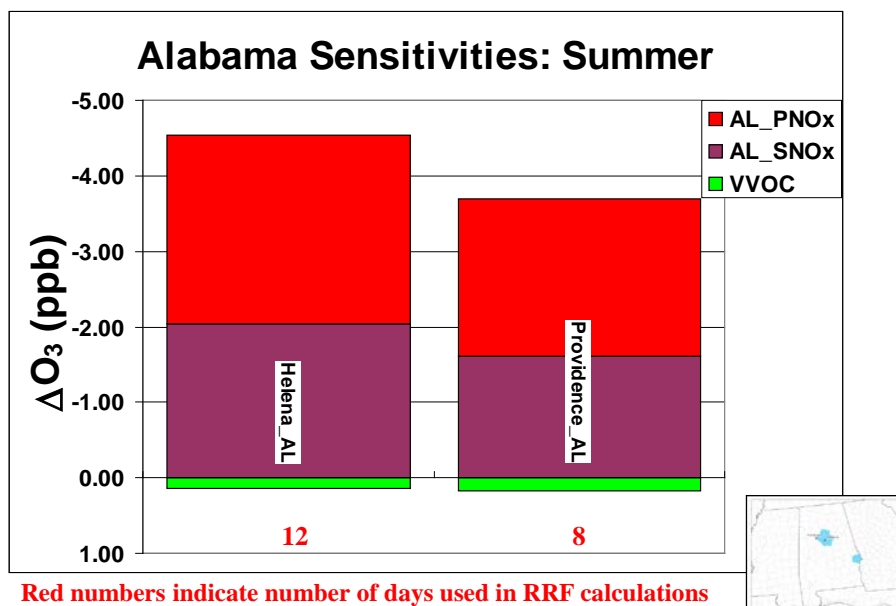
<sup>1</sup> **ASIP** - The Association for Southeastern Integrated Planning. In addition to the Regional Haze SIPs, many southeastern states were required to submit SIPs demonstrating attainment of the 8-hour ozone and PM<sub>2.5</sub> NAAQS. The states that participated in the VISTAS project concluded that a collaborative process was the most efficient approach for the collective states to develop information upon which to base attainment demonstrations.

<sup>2</sup> **SEMAP** - The Southeastern Modeling, Analysis, and Planning Project. The SEMAP project is designed to meet the following goals; leverage the resources and capabilities of local and state agencies in the ten southeastern states, assess regional air quality in relation to national ambient air quality standards and regional haze goals, determine possible emission controls that will reduce transport and assist states in meeting Clean Air Act requirements, offer interaction with stakeholders having various interests in the project, and provide documentation and data to support submittal to EPA of State Implementation Plans. The SEMAP agency participants mirror the VISTAS and ASIP projects.

<sup>3</sup> The "On the Way" Base D emissions inventory was a 2009 grown inventory (from 2002- base case) and included all known control programs, including the first phase of CAIR controls.

In this analysis, point source NO<sub>x</sub> emissions in Alabama and surface NO<sub>x</sub> emissions in Jefferson and Shelby counties were reduced by 30%. This resulted in about a 4 ppb reduction in 8-hour ozone concentrations in Birmingham (see graph). When VISTAS<sup>4</sup> region anthropogenic VOCs were collectively reduced by 30%, this resulted in a slight increase (dis-benefit) in ozone in Birmingham (see graph).

This analysis shows that NO<sub>x</sub> controls are effective in reducing ozone concentrations in Birmingham while VOC controls, even over a broad region, are ineffective in reducing ozone concentrations in Birmingham.



The NO<sub>x</sub>/VOC Ozone Sensitivity Analysis shown in this attachment is included in this demonstration for illustrative purposes when showing the general effects of NO<sub>x</sub> and VOC reductions on ozone concentrations in Alabama and the Southeast. While the

<sup>4</sup> **VISTAS** - The Visibility Improvement State and Tribal Association of the Southeast. VISTAS is one of five Regional Planning Organizations (RPOs) that have responsibility for coordinating development of SIPs and Tribal Implementation Plans (TIPs) in selected areas of the U.S. to address the requirements of the Regional Haze Rule (RHR). The VISTAS region includes the states of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia.

analysis was carried out a number of years ago, the continued downward trends in both NO<sub>x</sub> and VOC still clearly validate the results. In fact, the results shown in the analysis are now conservative due to further emissions reductions that have taken place through national measures as well as controls and shutdowns since the time the analysis was initially carried out. Again, this analysis is not included as the basis for this non-interference demonstration, but is simply included as additional evidence showing that the lower RVP level is unnecessary in the Birmingham area.